

WHAT IS CLAIMED IS:

1. A variable illumination angle inspection system, comprising:
a light source providing a light beam; ¹⁰⁰
a scanner ²⁰ imparting scanning deflection to the light beam to provide a
scanning beam approaching a substrate at a first angle; and
5 a deflection element selectively insertable into an optical path of the scanning
beam and deflecting the scanning beam so as to approach the substrate at a second
angle.
2. A variable illumination angle inspection system according to claim 1,
wherein the first angle is normal to said substrate.
- 10 3. A variable illumination angle inspection system according to claim 2,
wherein the second angle is oblique to said substrate.
4. A variable illumination angle inspection system according to claim 3,
wherein the scanner comprises one of a scanning mirror, a rotating mirror, a
polygonal mirror, and an acousto-optic deflector.
- 15 5. A variable illumination angle inspection system according to claim 4,
wherein the deflection element ^{170 118} comprises a mirror connected to an actuator arm. ¹⁹⁰
6. A variable illumination angle inspection system according to claim 4,
wherein the deflection element comprises a plurality of movable mirrors.
7. A variable illumination angle inspection system according to claim 6,
20 wherein the movable mirrors are disposed to direct the scanning beam at the second
angle to a focal position substantially corresponding to a focal position of the
scanning beam approaching the substrate at the first angle.
8. A variable illumination angle inspection system according to claim 4,
wherein the deflection element comprises a ⁵⁰⁰ glass optical element including a
25 first mirrored surface on a first side and a second mirror surface on a second side,
wherein the scanning beam enters a third side and is reflected from the first
mirrored surface and second mirrored surface obliquely toward the substrate at the
second angle.
9. A variable illumination angle inspection system according to claim 8,

wherein a focal position of an oblique beam approaching the substrate from the second angle when the deflection element is in the optical path coincides with a focal position of a normal beam approaching the substrate from the first angle when the deflection element is not in the optical path.

- 5 10. A variable illumination angle inspection system according to claim 8,
wherein the first mirrored surface⁶²⁰ is a partially mirrored surface transmitting a portion of incident light and reflecting a portion of incident light, and
wherein a second glass optical element is disposed adjacent the first mirrored surface to focus light transmitted through the first mirrored surface onto the same
10 coordinate of the substrate illuminated by the scanning beam reflected by the second mirrored surface toward the substrate at the second angle.

11. A variable illumination angle inspection system according to claim 10,
wherein a focal position of an oblique beam approaching the substrate from the second angle when the deflection element is in the optical path coincides with a
15 focal position of a normal beam approaching the substrate from the first angle when the deflection element is not in the optical path.

12. A variable illumination angle inspection system according to claim 4,
wherein the deflection element⁷⁴⁰ comprises a first optical element, a second optical element, and a third optical element,
20 wherein one side the second optical element is adjacent the first optical element and another side of the second optical element is adjacent the third optical element,

- wherein light incident to the deflection element includes both s- and p-polarizations in proportions selectable by use of at least one of a quarter-wave plate
25 and a half-wave plate;

wherein a s-polarizing beamsplitting element is provided between the first optical element and the second optical element,

wherein a p-polarizing beamsplitting element is provided between the second optical element and the third optical element, and

wherein the scanning beam incident on the second optical element is output obliquely toward the substrate as s-polarized light and p-polarized light from the first optical element and the second optical element, respectively, and

wherein the foci of the two oblique output beams coincide on the substrate.

- 5 13. A variable illumination angle inspection system according to claim 12, wherein a focal position of an oblique beam approaching the substrate from the second angle when the deflection element is in the optical path coincides with a focal position of a normal beam approaching the substrate from the first angle when the deflection element is not in the optical path.

- 10 14. A variable illumination angle inspection system for inspecting a substrate, comprising:

a light source providing a light beam;

- a scanning element adapted to output the light beam along a first optical path to the substrate, the first optical path including a portion incident to the substrate and forming a first angle relative to the substrate; and

- 15 a deflection element selectively introduced into the first optical path to output the light beam along a second optical path to the substrate, the second optical path including a portion incident to the substrate and forming a second angle relative to the substrate,

- 20 wherein the first angle is different from the second angle.

15. A variable illumination angle inspection system for inspecting a substrate according to claim 14, wherein the first angle is oblique to the substrate and the second angle is substantially perpendicular to the substrate.

16. A variable illumination angle inspection system for inspecting a substrate according to claim 14, wherein the second angle is oblique to the substrate and the first angle is substantially perpendicular to the substrate.

- 25 17. A variable illumination angle inspection system for inspecting a substrate according to claim 14, wherein the deflection element is selectively inserted into the first optical path by an actuator.

18. A variable illumination angle inspection system according to claim 14, wherein the scanning element comprises one of a scanning mirror, a rotating mirror, a polygonal mirror and an acousto-optic deflector.

19. A variable illumination angle inspection system according to claim 17, ¹⁸ wherein the deflection element comprises a glass optical element including a first mirrored surface on a first side and a second mirrored surface on a second side, wherein the scanning light beam enters a third side and is reflected from the first mirrored surface and second mirrored surface obliquely toward the substrate at the second angle.

20. A variable illumination angle inspection system according to claim 19, wherein a focal position of an oblique beam approaching the substrate from the second angle when the deflection element is in the first optical path coincides with a focal position of a normal beam approaching the substrate from the first angle when the deflection element is not in the first optical path.

21. A variable illumination angle inspection system according to claim 19, wherein the first mirrored surface is a partially mirrored surface transmitting a portion of incident light and reflecting a portion of incident light, wherein a second glass optical element is movably disposed adjacent the first mirrored surface to focus light transmitted through the partially mirrored surface onto the same coordinate of the substrate illuminated by the scanning beam reflected by the second mirrored surface toward the substrate at the second angle.

22. A variable illumination angle inspection system according to claim 21, wherein a focal position of an oblique beam approaching the substrate from the second angle when the deflection element is in the first optical path coincides with a focal position of a normal beam approaching the substrate from the first angle when the deflection element is not in the first optical path.

23. A variable illumination angle inspection system according to claim 16, wherein the deflection element comprises a first optical element, a second optical element, and a third optical element,

wherein one side the second optical element is adjacent the first optical element and another side of the second optical element is adjacent the third optical element,

wherein a s-polarizing beamsplitting element is provided between the first
5 optical element and the second optical element,

wherein a p-polarizing beamsplitting element is provided between the second optical element and the third optical element, and

wherein the scanning beam incident on the second optical element is output obliquely toward the substrate as s-polarized light and p-polarized light from the first
10 optical element and the second optical element, respectively.

24. A variable illumination angle inspection system according to claim 23,

wherein a focal position of an oblique beam approaching the substrate from the second angle when the deflection element is in the first optical path coincides with a focal position of a normal beam approaching the substrate from the first angle
15 when the deflection element is not in the first optical path.

25. A deflection element for use in a variable illumination angle substrate inspection system, comprising:

4.5 a first deflecting surface;

a second deflecting surface;

20 wherein each of said first deflecting surface and said second deflecting surface include a mirrored surface,

wherein said first deflecting surface is disposed at an angle with respect to said second deflecting surface,

wherein an illumination beam entering the deflection element from a first
25 direction is output from the deflection element in a second direction.

26. A deflection element for use in a variable illumination angle substrate inspection system according to claim 25, wherein the first direction is normal to a substrate to be inspected, and wherein the second direction is oblique to a substrate to be inspected.

30 27. A deflection element for use in a variable illumination angle substrate inspection system according to claim 25, wherein the first direction is oblique to a

substrate to be inspected, and wherein the second direction is normal to a substrate to be inspected.

28. A deflection element for use in a variable illumination angle substrate inspection system according to claim 26, wherein a focal position of an oblique illumination beam output from the deflection element coincides with a focal position of the incident illumination beam entering the deflection element.

29. A deflection element for use in a variable illumination angle substrate inspection system according to claim 26, further comprising:

an optical element disposed adjacent the partially mirrored surface having a focal point coinciding with a focal point of an oblique illumination beam output from the deflection element in the second direction.

30. A deflection element for use in a variable illumination angle substrate inspection system according to claim 26, further comprising:

a third deflecting surface;

a fourth deflecting surface;

a s-polarizing beamsplitting element provided in a primary optical path including the first deflecting surface and the second deflecting surface;

a p-polarizing beamsplitting element provided in a secondary optical path including the third deflecting surface and the fourth deflecting surface;

wherein each of said third deflecting surface and said fourth deflecting surface include a mirrored surface,

wherein said third deflecting surface is disposed at an angle with respect to said fourth deflecting surface,

wherein a scanning beam incident to the deflection element from the first direction normal to the substrate is output to at least one of the primary and second optical paths; and

wherein a portion of the scanning beam output from the first optical path is output in a first oblique direction and a portion of the scanning beam output from the second optical path is output in a second oblique direction.

31. A deflection element for use in a variable illumination angle substrate inspection system according to claim 30, further comprising:

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a polarizer element to control a polarization of the scanning beam incident to the deflection element,

wherein the scanning beam is controlled to include both s- and p-polarizations.

5 32. A deflection element for use in a variable illumination angle substrate inspection system according to claim 30, wherein a focal position of the first optical path coincides with a focal position of the second optical path.

33. A deflection element for use in a variable illumination angle substrate inspection system according to claim 25, wherein the deflection element comprises a
10 prism.

34. A deflection element for use in a variable illumination angle substrate inspection system according to claim 30, wherein the deflection element comprises a plurality of prisms.

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